



Original communication

A preliminary study of pores on epidermal ridges: Are there any sex differences and age related changes?

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ABSTRACT

The pore characteristics on the epidermal friction ridges are individualistic and thereby useful in the process of identification when used along with other minutiae details. The present work was undertaken with the objective of studying the sex difference and influence of age on the pore morphology. The study included 230 Indians belonging to various age groups. There was no significant difference in the pore characteristics between both the sexes. The average number of pores per centimeter of friction ridge was 8.40 in males and 8.83 in females. The closed type was the commonest type of pores seen. The size of pores varied from 69 μ m to 284 μ m in males and 66 μ m–287 μ m in females. The medium-sized pores were more common than the small and large-sized pores. The majority of the pores were situated in the periphery of the ridge. The commonest shape of pores seen was circular and oval shaped pores. As the age advances, the number of pores does not significantly vary. But, the size gradually increases, and the position and shape of pores changes with the age.

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1. Introduction

Identification is an essential requirement of any medicolegal investigation as the mistaken identity may pose a problem in delivering justice. The application of fingerprints showed a great improvement in the field of identification. The friction ridges on the hands arrange themselves in a peculiar pattern with ridge characteristics that are unique and used in establishing the identity.¹ In a scene of crime, there is a possibility of not having the complete fingerprints and thereby, enough ridge characteristics may not be available for comparison. In such cases, the epidermal pores that are claimed to be unique, helps in the identification if it is used along with other minutiae details.²

The science of poroscopy was first practiced by Dr. Edmond Locard in 1912, for establishing the identity of culprits in a theft case.^{3,4} He mentioned that the size, shape, position, and the number of pores on the ridges are individualistic and are useful in the process of identification.^{3,5} In the present study, an attempt has been made to study the influence of sex and age on the pore morphology.

2. Material and methods

The study sample consists of 230 Indians belonging to various age groups. Only the plain impressions of the left thumb were considered for the study. The printer's ink was spread uniformly on a glass slab with the help of a hand roller. The ink was spread so thin that the light can pass through it. After obtaining the informed consent (proxy informed consent wherever is applicable), the hands of the subjects were washed thoroughly and dried completely. Then, the subjects were made to touch the ink surface gently so that the ink smears only the superficial ridges and do not enter the pores or furrows. Later, the impressions from the medial, central and lateral surfaces of the left thumb were taken separately on a clean glass slide with minimal pressure applied to avoid smudging and marked appropriately.

A simple microscope was used to study the impressions for the pore characteristics under 50 \times magnification. As far as possible, a vertical ridge was selected randomly and pores were studied for a length of 1 cm of ridge. The appearance of pores under 50 \times magnification is shown in Fig. 1. The pore characteristics were recorded separately for medial, central and lateral impressions of each individual.

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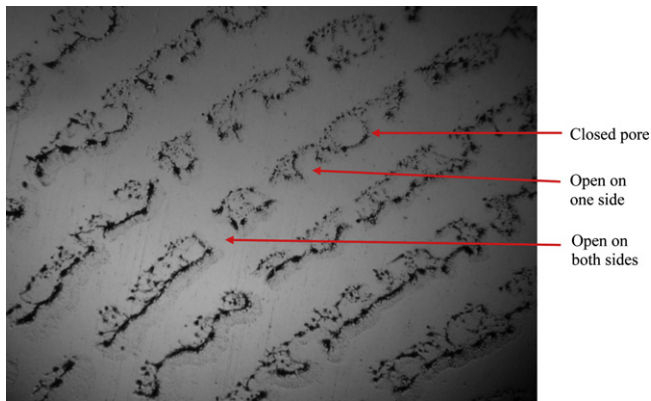


Fig. 1. Appearance of epidermal pores under 50× magnification.

An ocular micrometer scale was inserted into eyepiece of the microscope for taking measurement. The scale was 2 mm long and marked with 100 divisions. Each division is equal to 0.01 i.e., 10 μ m (μ m). One ocular division is equal to 10 μ m at 100× magnification, and 20 μ m at 50× magnification. Hence, to calculate the size of pores, the numbers of ocular divisions were multiplied by 20 μ m.

The results were analyzed statistically by using SPSS version 11. An average of the medial, central and lateral pore characteristics was calculated, and compared between both sexes and the different age groups. The significance between the sexes was tested with Independent-Samples *T*-test. The significance between the age groups was tested with ANOVA test. 'P' value less than 0.05 was considered to be significant.

3. Results

The present study comprised of 115 males and 115 females belonging to Indian population. The age of the study sample varied from 3 to 73 years (30.96 ± 18.27 years) in males and from 1 to 73 years (32.54 ± 20.06 years) in females. To study the influence of age on pore characteristics, the study population was arbitrarily divided into three age groups, viz., 1–20 years, 21–40 years and 41–75 years, which is shown in Fig. 2.

The number, types, position, size and size distribution of pores in both sexes is presented in Table 1, which showed statistically no significant difference between both the sexes. The number of pores per centimeter of friction ridge ranged from 5 to 16.3 (8.40 ± 2.01) in males and 5.3 to 16 (8.83 ± 2.09) in females. The closed type of pores outnumbered the pores that were open on one side of the ridge and the pores that were open on both sides of the ridge. The majority of the pores were situated in the periphery and middle of

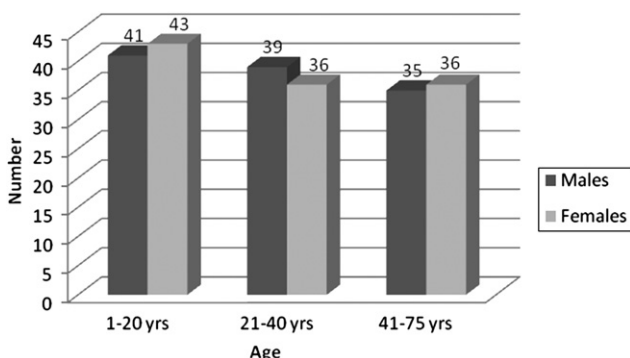


Fig. 2. Age distribution of study sample.

Table 1

Comparison of pore characteristics between both sexes.

Pore characteristics	Male	Female	P
Number of pores/cm of ridge	8.40 ± 2.01	8.83 ± 2.09	0.107
Types:			
Closed	67%	65%	0.668
Open on one side	26%	28%	0.065
Open on both sides	7%	7%	0.888
Position:			
Periphery	50%	49%	0.665
Middle	43%	45%	0.055
Whole width	7%	6%	0.640
Size:			
Minimum (μ m)	69	66	0.270
Maximum (μ m)	284	287	0.710
Size distribution:			
Small-size (<100 μ m)	39%	37%	0.989
Medium-size (101–200 μ m)	44%	46%	0.080
Large-size (>200 μ m)	17%	17%	0.330

the ridge. The size of pores varied from 69 μ m to 284 μ m in males and 66 μ m–287 μ m in females. The size of pores was divided into three groups, viz., small (less than 100 μ m), medium (101 μ m–200 μ m) and large (more than 200 μ m) sized pores. In both sexes, the majority of the pores was medium-sized, followed by small-sized, and the least was the large-sized pores. The shapes of the pores are presented in Table 2, which showed no significant difference between the sexes. In both sexes, highest numbers of pores were circular and oval shaped, and the least was the rectangular and rhomboid shaped pores.

The age-wise distribution of number, types and position of pores in both sexes is shown in Table 3. As the age advances in males, the closed type of pores decreases, with an increase in pores that is open on one side and open on both sides of the ridge. However, no significant changes were observed in females. As the age advances in males, pores occupying the middle of the ridge decrease with an increase in pores occupying the whole width. However, no significant changes were observed in females. The size of the pores and its distribution are shown in Table 3. The size of the pores increases with an advancement in age in both sexes. In males, the small-sized pores decrease with an increase in large-sized pores as the age increases. Whereas in females, the medium-sized pores decrease with an increase in large-sized pores as the age advances. Table 4 presents the shape of pores in different age groups. As the age advances, circular shaped pores decrease with an increase in oval shaped pores in males. Whereas in females, no significant changes were observed between the age groups.

4. Discussion

In the present study, the number pores per centimeter of the epidermal ridge from the left thumb impression ranged from 5 to 16.3 (mean 8.40) in males and from 5.3 to 16 (mean 8.83) in females; the difference between both sexes was statistically not significant (Table 1). Ashbaugh quoted that Edmond Locard has studied the finger and palm prints of two accused persons in a theft

Table 2

Comparison of shapes of pores between both sexes.

Shapes	Male	Female	P
Circular	48%	45%	0.834
Oval	21%	22%	0.193
Rectangle	2%	2%	0.107
Rhomboid	3%	2%	0.754
Triangle	4%	6%	0.055
Elongate	9%	11%	0.057
Miscellaneous	7%	7%	0.890
No shape	6%	5%	0.511

Table 3

Age-wise distribution of number, types, position, size and size distribution of pores.

Pore characteristics	Male				Female			
	1–20yrs	21–40yrs	41–75yrs	P	1–20yrs	21–40yrs	41–75yrs	P
Number of pores/cm of ridge	8.73	8.44	7.96	0.251	9.22	8.37	0.83	0.196
Types:								
Closed	72%	69%	57%	0.004	66%	64%	65%	0.380
Open on one side	23%	24%	34%	0.042	26%	30%	30%	0.850
Open on both sides	5%	7%	9%	0.038	8%	6%	5%	0.055
Position:								
Periphery	49%	51%	52%	0.934	50%	46%	48%	0.262
Middle	46%	42%	39%	0.020	42%	48%	45%	0.852
Whole width	5%	7%	9%	0.045	8%	6%	7%	0.098
Size:								
Minimum (μm)	63	65	80	0.007	66	67	64	0.698
Maximum (μm)	256	277	324	0.000	259	273	335	0.000
Size distribution:								
Small-size (<100 μm)	43%	42%	31%	0.001	37%	37%	37%	0.749
Medium-size (101–200 μm)	43%	44%	47%	0.956	48%	46%	43%	0.017
Large-size (>200 μm)	14%	14%	23%	0.003	15%	17%	20%	0.015

Table 4

Age-wise distribution of shapes of pores.

Shapes of pores	Male				Female			
	1–20yrs	21–40yrs	41–75yrs	P	1–20yrs	21–40yrs	41–75yrs	P
Circular	52%	45%	43%	0.014	46%	45%	42%	0.442
Oval	21%	19%	25%	0.034	23%	22%	20%	0.314
Rectangle	2%	3%	2%	0.011	3%	2%	3%	0.089
Rhomboid	3%	3%	2%	0.154	1%	4%	2%	0.003
Triangle	4%	5%	5%	0.871	6%	5%	8%	0.081
Elongate	10%	11%	9%	0.312	10%	10%	14%	0.016
Miscellaneous	5%	10%	7%	0.000	6%	7%	7%	0.982
No shape	3%	4%	7%	0.000	5%	5%	4%	0.395

case and found 9 to 18 pores per centimeter of ridge.³ Bindra et al. have studied the finger and palm prints, and found 8 to 25 pores per centimeter of ridge, where the minimum and maximum number of pores was observed in the thenar and hypothenar regions, respectively.⁶ Whereas, findings of the present study were only from the pulp of the finger. This shows that the number of pores per centimeter of ridge is less in distal parts of the finger compared to the palm.

In the present study, majority of the pores were of closed type, followed by open on one side and open on both sides in both sexes (Table 1). Bindra et al. observed similar findings in their study.⁶ In the present study, the maximum number of pores was situated in the periphery and middle of the ridge in both sexes; the peripheral pores slightly predominate over the middle pores. However, Bindra et al. found equal distribution in the middle as well as the periphery of the ridge.⁶ This suggests that the position of pores on the ridge varies in different fingers and palm. In the present study, the pores situated in the periphery of the ridge were either of closed type or open on one side. Whereas, the pores situated in the middle of the ridge were of closed type.

In the present study, the size of pores varied from 69 μm to 284 μm in males and 66 μm –287 μm in females (Table 1). Whereas in Locard's study, it varied from 88 μm to 220 μm .^{3,4} In the present study, the majority of the pores was medium-sized, followed by small-sized, and the least was the large-sized pores in both sexes (Table 1). This is consistent with the study of Bindra et al.⁶

The pores on the ridge could form various shapes viz., circular, oval, rectangular, rhomboid, triangle, elongate, miscellaneous (dumple, star, etc). Some times, no shape could be made out. In the present study, there was no significant difference in the shape of pores between both the sexes (Table 2). The highest number of

pores was circular and oval shaped, and the least was the rectangular and rhomboid shaped pores. Whereas, Bindra et al. found the rhomboid shaped pores as the commonest, followed by the circular, elliptical and rectangular shaped pores.⁶

In the present study, we studied the influence of age on pore characteristics. With the advancement in age, no significant difference was observed in the number of pores in both the sexes (Table 3). As the age advances in males, the closed type of pores decreases with an increase in pores that is open on one side and open on both sides of the ridge. However, no significant changes were observed in females (Table 3). The pores occupying the middle of the ridge decrease and the pores occupying the whole width increase with advancement of age in males. However, no significant changes were observed in females (Table 3). The size of the pores increases with an advancement in age in both the sexes (Table 3). In males, the small-sized pores decrease with an increase in large-sized pores as the age advances. Whereas in females, the medium-sized pores decrease with an increase in the large-sized pores as the age advances (Table 3). The circular shaped pores decrease and the oval shaped pores increase with advancement of age in males. Whereas in females, no significant changes were observed between the age groups (Table 4).

5. Conclusion

In partial fingerprints, impressions of finger print alone may be difficult to identify the person. In such instances, inclusion of poroscopy details may help the examiner in reducing the chances of error.

In the present study, the pore characteristics of the left thumb print were studied in the Indian population to understand the

morphology of pores on the friction ridge, which showed encouraging results. The number of pores on the friction ridge does not have sex and age influence. Whereas, other parameters such as type, size, position and shape of pores do not have sex influence, but changes as the age advances. Thus, we conclude that the number of pores on the friction ridge is a more reliable parameter for identification when used along with other minute details. Since the other parameters changes with age, one should be careful in applying these for identification, especially when comparing with an old data.

There are certain limitations in the present study. The impressions were taken on a glass slide with minimal pressure to avoid smudging of the pores, which may not be similar with impressions recovered at crime scene. Hence, we recommend for further study with firm pressure on different surfaces. Also, impressions of other fingers and latent prints need to be studied.

Ethical approval

None.

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Conflict of interest

The authors have no conflict of interest to declare.

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